



# BBO (BETA-BARIUM BORATE)

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QUOTE

BBO (beta-BaB<sub>2</sub>O<sub>4</sub>) is an excellent non-linear crystal for frequency-doubling (SHG) of Visible and Near IR laser light, OPO/OPG/OPA pumped by ultrafast pulses of wavelengths in the Near IR to UV, and sum-frequency mixing (SFM) into the Visible to the deep UV. BBO is one of the few practical crystal for use below 500 nm in SHG and SFM.

BBO crystal has broad tunability, high damage threshold, and high efficiency. BBO's small acceptance angle requires a very good beam quality and its large walkoff results in output beams that are very elliptical or slit-like. Type I is usually much more efficient than type II operation. BBO can not be used for NCPM (temperature tuned) application. BBO is very good for tunable laser sources, such as ultrafast Ti:Sapphire or dye lasers.

BBO is also widely used for SHG, 3HG, 4HG, and autocorrelation of femtosecond and picosecond Ti:Sapphire lasers; SHG, 3HG, 4HG, 5HG of YAG lasers at 1064 nm and 1320 nm to yield output of 212–660nm; SHG of tunable dye or solid-state laser sources from 410–750 nm to yield output of 205–375 nm, SFM of dye laser and YAG harmonics to yield output of 189–400 nm; DFM (difference-frequency mixing) from the Visible to the IR range up to over 3000 nm; OPO pumped with SHG or 3HG of YAG or Ti:Sapphire with an output range of 400–3000 ; Intracavity SHG of Argon ion lasers (488, 514 nm) or Copper vapor lasers (510 nm, 578 nm).

## PRODUCTS:

- [LBO](#)
- [KTP](#)
- [BBO](#)
- [Nd:YVO4](#)

## Crystal Structural and Physical Properties

Crystal Structure	Trigonal, space group R <sub>3c</sub>
Cell Parameters	a = b = 12.532Å, c = 12.717Å..., Z = 6
Melting point	1095± 5°C
Transition temperature	925± 5°C
Optical homogeneity	d n ~ 10 <sup>-6</sup> /cm
Mohs hardness	4
Density	3.85 g/cm <sup>3</sup>
Absorption Coefficient	< 0.1%/cm (at 1064nm)
Specific heat	490 J/kg/°C
Hygroscopic susceptibility	low
Thermal expansion coefficients	a, 4 x 10 <sup>-6</sup> /K; c, 36 x 10 <sup>-6</sup> /K
Thermal conductivity	Perpendicular to c, 1.2 W/m/°C Parallel to c, 1.6 W/m/°C

## Linear Optical Properties

Transparency range	189-3500 nm
Refractive indices:	$n_e = 1.5425$ , $n_o = 1.6551$ @ 1064 nm $n_e = 1.5555$ , $n_o = 1.6749$ @ 532 nm $n_e = 1.6146$ , $n_o = 1.7571$ @ 266 nm
Therm-optic coefficients	$dn_o/dT = -9.3 \times 10^{-6}/^{\circ}\text{C}$ $dn_e/dT = -16.6 \times 10^{-6}/^{\circ}\text{C}$

## Sellmeier Equations (l in mm)

$$n_o^2(l) = 2.7359 - 0.01354l^2 + 0.01878/(l^2 - 0.01822)$$

$$n_e^2(l) = 2.3753 - 0.01516l^2 + 0.01224/(l^2 - 0.01667)$$

## Nonlinear Optical Properties

Phase-matchable output wavelength	189 - 1750 nm
NLO coefficients	$d_{11} = 5.8 \times d_{36}$ (KDP) $d_{31} = 0.05 \times d_{11}$ $d_{22} < 0.05 \times d_{11}$
Electro-optic coefficients	$\gamma_{11} = 2.7$ pm/V
Half-wave voltage	48 KV (at 1064 nm)
Damage threshold	5 GW/cm <sup>2</sup> (10 ns) @1064nm 10 GW/cm <sup>2</sup> (1.3 ns) @ 1064 nm 1 GW/cm <sup>2</sup> (10 ns) @532 nm 7 GW/cm <sup>2</sup> (250 ps) @ 532 nm

## BBO Typical Specifications

Thin crystals: (5-10) x (5-10) x (0.1 - 1) mm<sup>3</sup>

Regular sizes: 4 x 4 mm<sup>2</sup> to 20 x 20 mm<sup>2</sup> in diameter, 3 - 30 mm in length

Different cuts, sizes and AR coatings are available upon request.

BBO is hygroscopic. In application, protective coating or AR coating or crystal housing is usually recommended. Data-sheet available for download in PDF:

[DOWNLOAD PDF](#)

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